



**MODEL NO. : TM150TDSG52**

**ISSUED DATE: 2012/05/24**

**VERSION : 1.0**

☒ **Preliminary Specification**

☐ **Final Product Specification**

**SHANGHAI AVIC Confirmed :**

| Prepared by | Checked by | Approved by |
|-------------|------------|-------------|
| Pean        |            |             |

This technical specification is subjected to change without notice

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## RECORD OF REVISION

| Rev | Issued Date | Description         | Editor  |
|-----|-------------|---------------------|---------|
| 1.0 | 2012-05-24  | Preliminary Release | Pean Wu |
|     |             |                     |         |
|     |             |                     |         |
|     |             |                     |         |
|     |             |                     |         |
|     |             |                     |         |
|     |             |                     |         |



## 1. OUTLINE

### 1.1 STRUCTURE AND PRINCIPLE

TM150TDSG52 module is composed of the amorphous silicon thin film transistor liquid crystal display (a-Si TFT LCD) panel structure with driver LSIs for driving the TFT (Thin Film Transistor) array and a backlight. The a-Si TFT LCD panel structure is injected liquid crystal material into a narrow gap between the TFT array glass substrate and a color-filter glass substrate.

Color (Red, Green, Blue) data signals from a host system (e.g. PC, signal generator, etc.) are modulated into best form for active matrix system by a signal processing board, and sent to the driver LSIs which drive the individual TFT arrays. The TFT array as an electro-optical switch regulates the amount of transmitted light from the backlight assembly, when it is controlled by data signals. Color images are created by regulating the amount of transmitted light through the TFT array of red, green and blue dots.

### 1.2 APPLICATIONS

- Monitor for industrial display

### 1.3 FEATURES

- a-Si TFT active matrix
- LVDS interface
- R.G.B input 8bit, 16.7 millions colors (6bit+HiFRC)
- R.G.B input 6bit selectable, 262K colors
- Resolution XGA (1024× 768 pixels)
- Wide viewing angle 80°/80°/ 80°/80° (L/R/U/D)
- High contrast ratio 600:1
- Module size 326.5 (H) ×253.5 (V) ×11.8 (D) mm
- Fast response time (Ton+ Toff= 8ms)
- High gamut (60%)
- Edge light type backlight (White-LED)
- Backlight driver circuit included
- RoHS compliance



## 2. GENERAL SPECIFICATIONS

|                          |   |
|--------------------------|---|
| Display area             | 304.128 (W) x 228.096 (V) mm (typ.)                     |
| Diagonal size of display | 38.0 cm (15.0 inches)                                   |
| Drive system             | a-Si TFT active matrix                                  |
| Display color            | 16.7 M colors (6bit+ HiFRC); 262K colors selectable     |
| Pixel                    | 1,024 (H) × 768(V) pixels                               |
| Pixel arrangement        | RGB vertical stripe                                     |
| Dot pitch                | 0.099 (H) × 0.297(V) mm                                 |
| Pixel pitch              | 0.297(H) × 0.297(V) mm                                  |
| Module size              | 326.5mm (H)(typ.) ×253.5mm (V)(typ.) ×11.8 mm(D) (typ.) |
| Weight                   | (1000 g typ.)   |
| Contrast ratio           | 600 :1 (typ.)   |
| Viewing angle(U/D/L/R)   | 80°/ 80°/80°/80° (typ.)                                 |
| Color gamut              | 60% (typ.)  |
| Response time            | 8 ms (typ.)   |
| Luminance                | 250 cd/m <sup>2</sup> (typ.)                            |
| Transmissive Mode        | Normally White  |
| Surface Treatment        | Anti Glare  |
| Signal system            | LVDS 1 port   |
| Power supply voltage     | LCD panel: 3.3V<br>LED backlight: 12V                   |
| Backlight                | White-LED   |
| Power consumption        | (11 W max)  |



### 3. ABSOLUTE MAXIMUM RATINGS

| Parameter                 | Symbol | Rating      | Unit             | Remarks   |
|---------------------------|--------|-------------|------------------|-----------|
| Power Supply Voltage      | VCC    | -0.3 ~ +4.0 | V                | Ta = 25°C |
| Input voltage for signals | Vi     | -0.3 ~ +4.0 | V                | Ta = 25°C |
| Storage temperature       | Tst    | -20 ~ +65   | °C               | Note 1    |
| Operating temperature     | Top    | 0 ~ +65     | °C               | Note 1, 2 |
| Absolute humidity         | AH     | ≤ 70        | g/m <sup>3</sup> | Ta > 50°C |

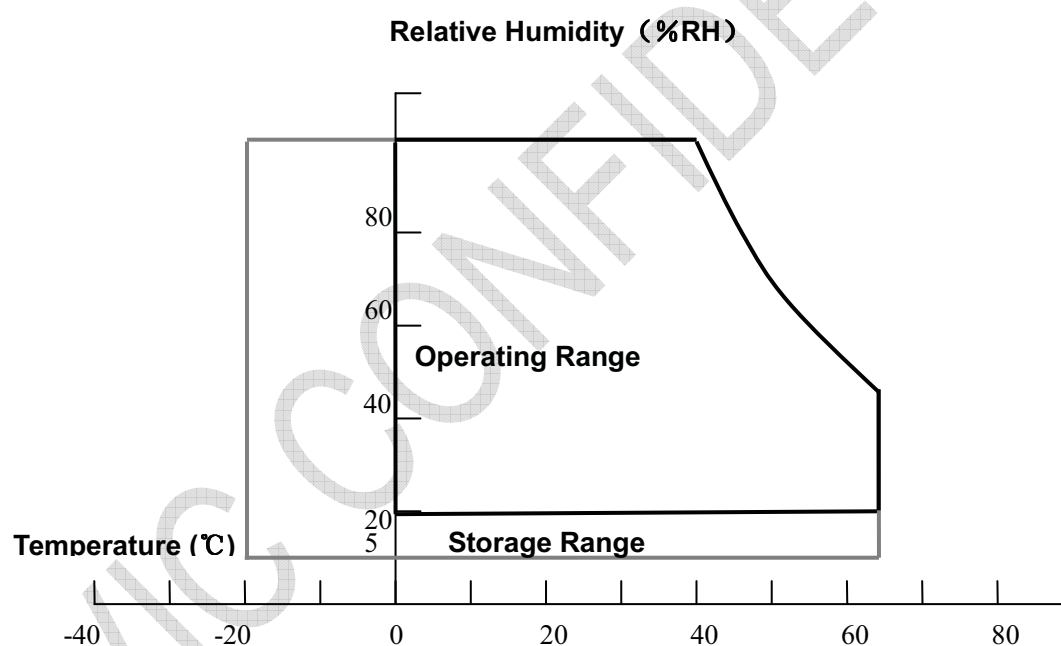
Note1: Temperature and relative humidity range is shown in the figure below.

(a) 90%RH Max. (Ta ≤ 40°C)

(b) Wet-bulb temperature should be 39°C Max. (Ta > 40°C)

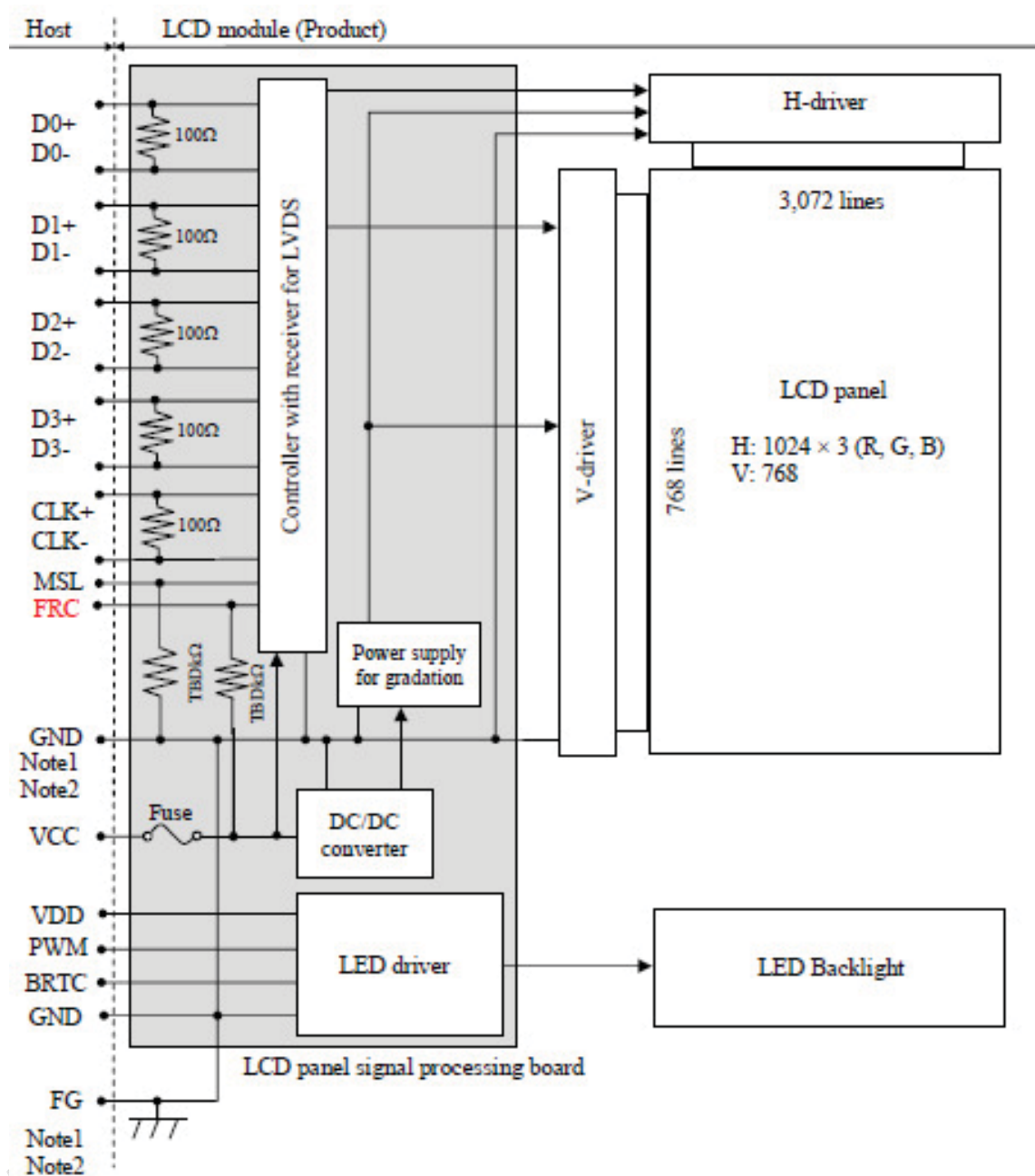
(c) No condensation.

Note2: The temperature of panel display surface area should be -0°C Min and 65°C Max.





## 4. BLOCK DIAGRAM



Note1: Relations between GND (Signal ground and LED driver ground) and FG (Frame ground) in

Note2: GND and FG must be connected to customer equipment's ground, and it is recommended

that

these grounds be connected together in customer equipment.



## 5. MECHANICAL SPECIFICATIONS

| Parameter    | Specification   | Unit |
|--------------|---|------|
| Module size  | 326.5± 0.5 (W) × 253.5 ± 0.5 (H) × 11.8 ± 0.3 (D)           | mm   |
| Display area | 304.128 (W) × 228.096 (V) mm (typ.)<br>[38cm (15.0 inches)] | mm   |
| Weight       | (1000 g typ.)   | g    |

## 6. ELECTRICAL CHARACTERISTICS

### 6.1 DRIVING FOR LCD

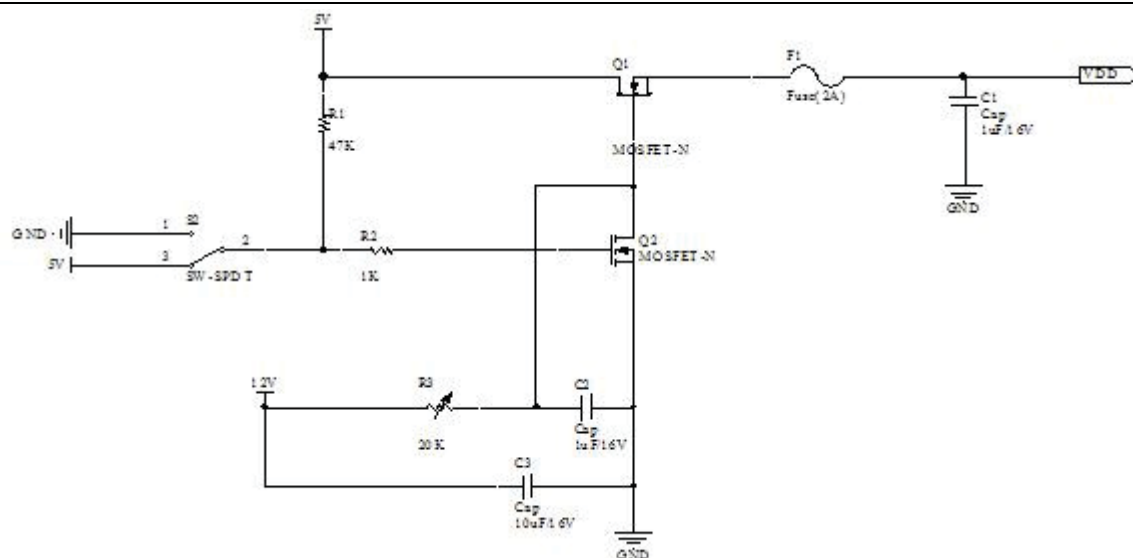
| Parameter  |      | Symbol            | min. | typ.  | max.  | Unit | Remarks                 |
|--|------|-------------------|------|-------|-------|------|-------------------------|
| Power supply voltage                                   |      | VCC               | 3.0  | 3.3   | 3.6   | V    | -                       |
| Power supply ripple                                    |      | Vp-p              |      |       | 200mV | V    | Including spike noise   |
| Power supply current                                   |      | ICC               | -    | (500) | (550) | mA   | at VDD = 3.3V<br>Note 1 |
| Permissible ripple voltage                             |      | VRP               | -    | -     | 100   | mV   | VDD                     |
| Differential input voltage                             |      | Vid               | 250  |       | 450   | mV   |                         |
| Differential input threshold voltage for LVDS receiver | High | VTH               | -    | -     | 100   | mV   | VCM = 1.25V<br>Note2    |
|  | Low  | VTL               | -100 | -     |       | mV   |                         |
| Input voltage width for LVDS receiver                  |      | Vi                | 0    | -     | 1.90  | V    | -                       |
| Terminating resistor                                   |      | RT                | -    | 100   | -     | Ω    | -                       |
| Rush current   |      | I <sub>rush</sub> | -    | -     | 1.5   | A    | Note3                   |
| Input voltage for MSL signals                          | High | VFH               | 2.0  |       | VCC   | V    |                         |
|  | Low  | VFL               | 0    |       | 0.4   | V    |                         |

Note 1: All black pattern

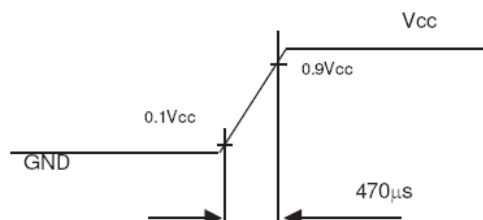
Note 2: Common mode voltage for LVDS receiver

Note 3: Measurement Conditions:





Vcc rising time is 470μs



## 6.2 DRIVING FOR BACKLIGHT

(Ta=25°C) Note1

| Parameter                     | Symbol | min.  | typ.  | max.  | Unit  | Remarks |
|-------------------------------|--------|-------|-------|-------|-------|---------|
| Power supply voltage          | VDD    | 10.8  | 12.0  | 12.6  | V     |         |
| Power supply current          | IDD    | -     | (750) | (800) | mArms |         |
| Light bar life time           | Hr     | 30000 | -     | -     | Hour  | Note1   |
| Input voltage for PWM signal  | High   | VDFH1 | 2.0   | 5.0   | V     |         |
|                               | Low    | VDFL1 | 0     | 0.4   | V     |         |
| Input voltage for BRTC signal | High   | VDFH2 | 2.0   | 5.0   | V     |         |
|                               | Low    | VDFL2 | 0     | 0.4   | V     |         |
| PWM frequency                 | fpwm   | 200   |       | (20K) | Hz    |         |
| PWM pulse width               | tPWH   | 10    |       |       | us    |         |

Note1: The operating lifetime is mean time to half-luminance. In case the product works under room temperature environment.



## 7. CONNECTIONS AND FUNCTIONS FOR INTERFACE PINS

### 7.1 LCD PINS

CN1 socket(Module side): 185083-20121 ( P-TWO ELECTRIC TECHNOLOGY CO., LTD.)

| Pin No. | Symbol | Signal                            | Description               |                           |                            | Remarks |
|---------|--------|-----------------------------------|---------------------------|---------------------------|----------------------------|---------|
|         |        |                                   | Input data signal: 8bit   |                           | Input data signal:<br>6bit |         |
|         |        |                                   | MAP A                     | MAP B                     |                            |         |
| 1       | VCC    | Power supply                      | Power supply              |                           |                            |         |
| 2       | VCC    |                                   |                           |                           |                            |         |
| 3       | GND    | Ground                            | Ground                    |                           |                            | -       |
| 4       | GND    |                                   |                           |                           |                            |         |
| 5       | D0-    | Pixel data                        | R2-R7,G2                  | R0-R5,G0                  |                            |         |
| 6       | D0+    |                                   |                           |                           |                            |         |
| 7       | GND    | Ground                            | Ground                    |                           |                            | -       |
| 8       | D1-    | Pixel data                        | G3-G7,B2-B3               | G1-G5,B0-B1               |                            |         |
| 9       | D1+    |                                   |                           |                           |                            |         |
| 10      | GND    | Ground                            |                           |                           |                            |         |
| 11      | D2-    | Pixel data                        | B4-B7,DE                  | B2-B5,DE                  |                            |         |
| 12      | D2+    |                                   |                           |                           |                            |         |
| 13      | GND    | Ground                            | Ground                    |                           |                            |         |
| 14      | CLK-   | Pixel clock                       | Pixel clock               |                           |                            |         |
| 15      | CLK+   |                                   |                           |                           |                            |         |
| 16      | GND    | Ground                            | Ground                    |                           |                            |         |
| 17      | D3-    | Pixel data                        | R0-R1,<br>G0-G1,<br>B0-B1 | R6-R7,<br>G6-G7,<br>B6-B7 | Ground                     |         |
| 18      | D3+    |                                   |                           |                           |                            |         |
| 19      | MSL    | Selection of LVDS Input data map  | High                      | Low or NC                 | High                       | -       |
| 20      | FRC    | Selection of the number of colors | Low                       |                           | High or NC                 |         |

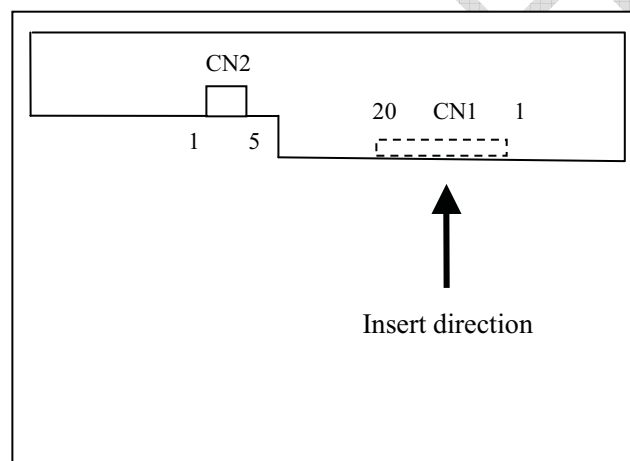


## 7.2 BACKLIGHT PINS

CN2: MSB24038P5 (Produced by STM) or equivalent.

| Pin | Symbol | Description                                  |
|-----|--------|--|
| 1   | VDD    | 12V  |
| 2   | GND    | Ground                                       |
| 3   | BRTC   | Back light ON/OFF control:<br>5V-On / 0V-Off |
| 4   | PWM    | PWM Luminance control                        |
| 5   | NC     | NC   |

## 7.3 POSITION OF PLUGS AND SOCKET





## 8. DISPLAY COLORS AND INPUT DATA INFORMATION

### 8.1 DISPLAY COLORS AND DATA SIGNAL

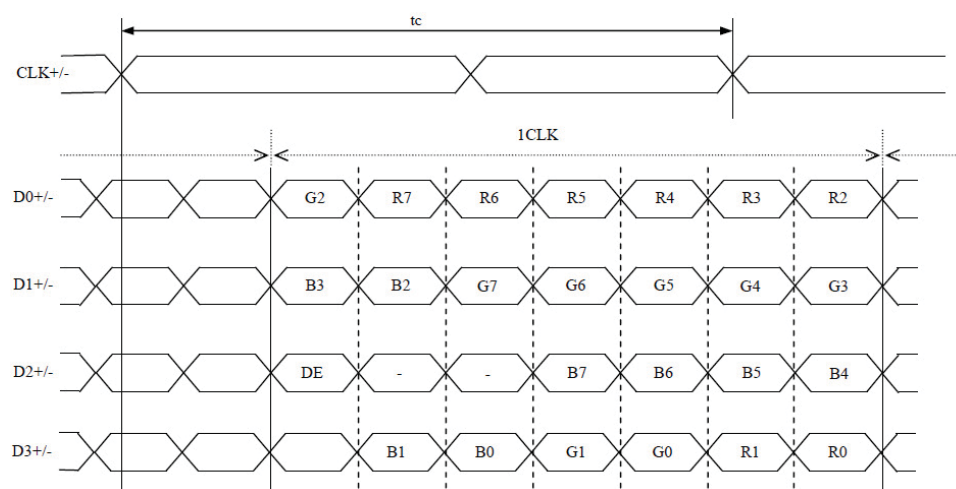
This product can display in equivalent to 16,777,216 colors in 256 scales. Also the relation between display colors and input data signals is as the following table. And it can display in equivalent to 262,144 colors in 64 scales, without data signals R7, R6, G7, G6, B7, B6 in the following table.

| Display colors  |                        | Data signal (0:Low level, 1:High Level) |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|-----------------|------------------------|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
|                 |                        | R7                                      | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| Basic Color     | Black                  | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |
|                 | Blue                   | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |
|                 | Red                    | 1                                       | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
|                 | Magenta                | 1                                       | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |    |
|                 | Green                  | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
|                 | Cyan                   | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |    |
|                 | Yellow                 | 1                                       | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
|                 | White                  | 1                                       | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |    |
| Red grayscale   | Black                  | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
|                 | <div>Dark↕Bright</div> | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
|                 |                        | 0                                       | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
|                 |                        | :                                       | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |    |
|                 | 0                      | 0                                       | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |    |
|                 | Bright                 | 1                                       | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
|                 | Red                    | 1                                       | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
| Green grayscale | Black                  | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
|                 | <div>Dark↕Bright</div> | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
|                 |                        | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
|                 |                        | :                                       | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |    |
|                 | 0                      | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0  | 0  | 0  | 0  | 0  | 0  |    |    |
|                 | Bright                 | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
|                 | Green                  | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
| Blue grayscale  | Black                  | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |    |
|                 | <div>Dark↕Bright</div> | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  |    |
|                 |                        | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  |    |
|                 |                        | :                                       | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  | :  |    |
|                 | 0                      | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  |    |
|                 | Bright                 | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 0  |    |
|                 | Blue                   | 0                                       | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1  |    |

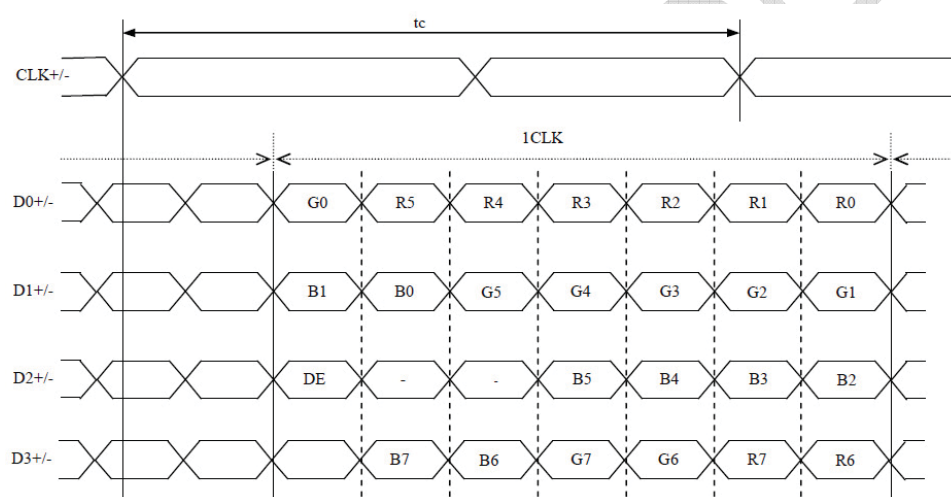


## 8.2 DATA MAP

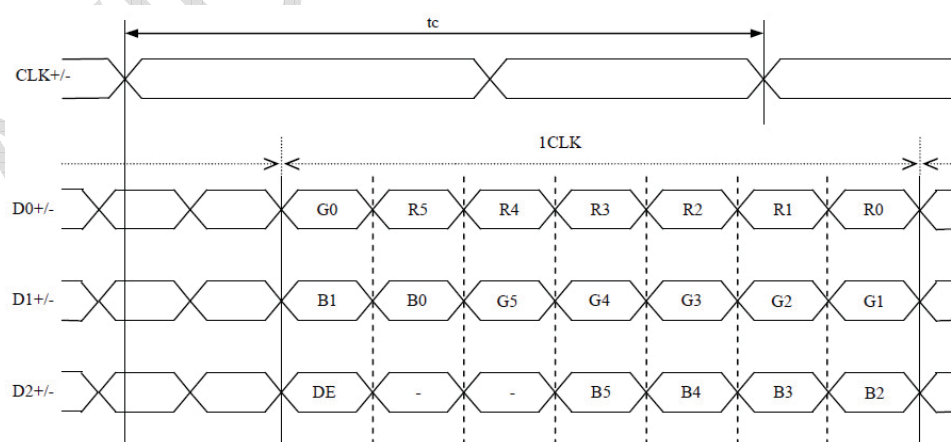
(1) LVDS Input data signal: 8bit, MAP A (MSL: High, FRC: Low)



(2) LVDS Input data signal: 8bit, MAP B (MSL: Low or NC, FRC: Low)



(3) Input data signal: 6bit (MSL: High, FRC: High or NC)





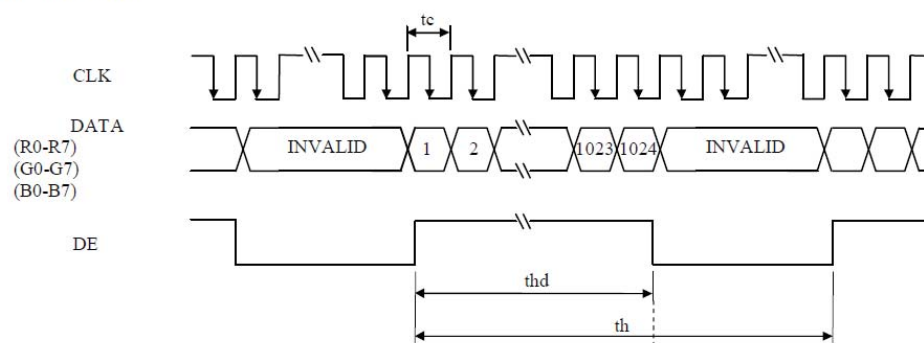
## 9. INTERFACE TIMING

### 9.1 TIMING CHARACTERISTICS

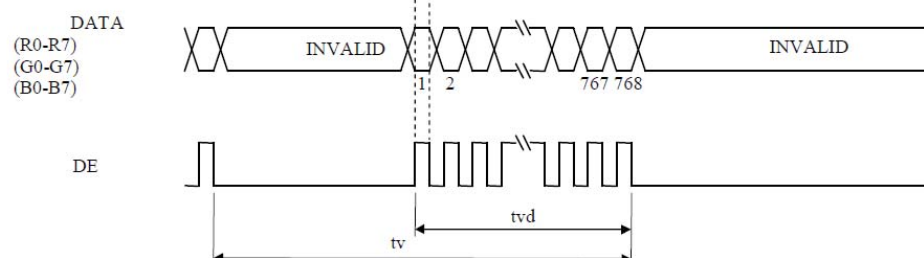
| Parameter          |                | Symbol | min.  | typ.  | max.  | Unit | Remarks            |
|--------------------|----------------|--------|-------|-------|-------|------|--------------------|
| Clock              | Frequency      | 1/tc   | 50    | 65.0  | 81.25 | MHz  | 15.384ns<br>(typ.) |
|                    |                | tc     | 20    | 15.4  | 12.31 | ns   |                    |
| Horizontal signals | Cycle          | th     | 16.54 | 20.68 | 25.77 | μs   | 48.36kHz<br>(typ.) |
|                    |                |        | 1150  | 1344  | 1800  | CLK  |                    |
|                    | Display period | thd    | 1024  |       |       |      | -                  |
| Vertical signals   | Cycle          | tv     | 13.1  | 16.67 | 20    | ms   | 60.0Hz(typ.)       |
|                    |                |        | 776   | 806   | 1023  | H    |                    |
|                    | Display period | tvd    | 768   |       |       |      | -                  |

### 9.2 INPUT SIGNAL TIMING CHART

Horizontal timing



Vertical timing





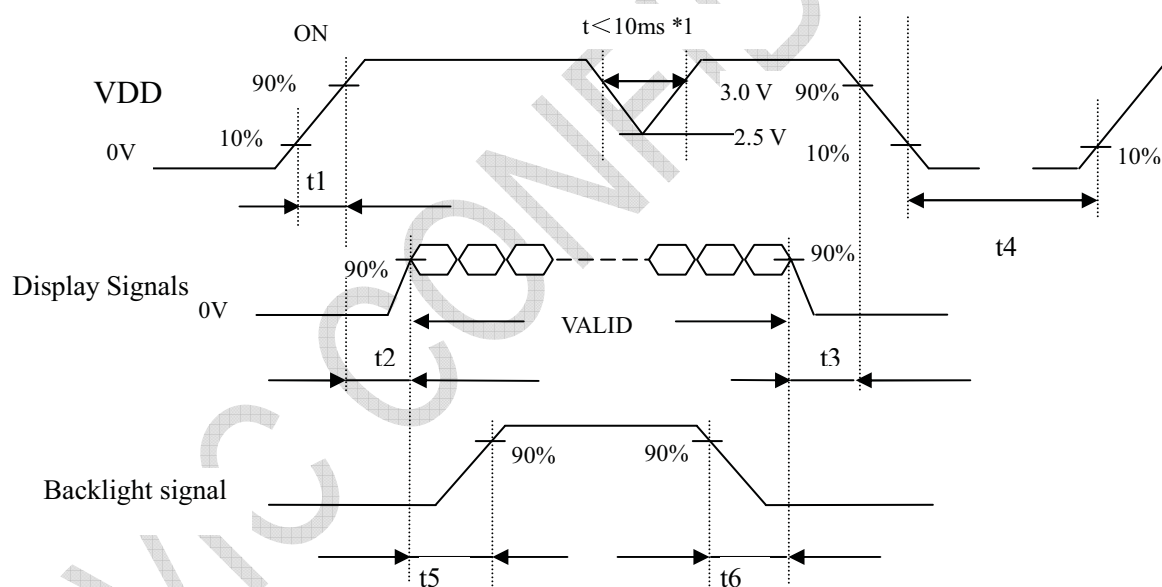
### 9.3 PIXEL DATA ALIGNMENT OF DISPLAY IMAGE

The following chart is the coordinates of per pixel

|  |  |  |          |          |          |     |             |
|--|--|--|----------|----------|----------|-----|-------------|
| <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">D(1,1)</div> <div style="border: 1px solid black; padding: 2px;"> <div style="display: flex; justify-content: space-between; width: 100%;"> <span>R</span> <span>G</span> <span>B</span> </div> </div> </div> |  |  | D(1,1)   | D(2,1)   | D(3,1)   | ... | D(1024,1)   |
|  |  |  | D(1,2)   | D(2,2)   | D(3,2)   | ... | D(1024,2)   |
|  |  |  | D(1,3)   | D(2,3)   | D(3,3)   | ... | D(1024,3)   |
|  |  |  | .        | .        | .        | ... | .           |
|  |  |  | .        | .        | .        | ... | .           |
|  |  |  | .        | .        | .        | ... | .           |
|  |  |  | D(1,768) | D(2,768) | D(3,768) | ... | D(1024,768) |

### 9.4 POWER SUPPLY VOLTAGE SEQUENCE

#### 9.4.1 The sequence of backlight and power



#### Timing Specifications:

- t1 :  $0.5\text{ms} < t1 < 10\text{ms}$ ;
- t2 :  $0.5\text{ms} < t2 < 50\text{ms}$ ;
- t3 :  $0\text{ms} < t3 < 50\text{ms}$ ;
- t4 :  $t4 > 1000\text{ms}$ ;
- t5 :  $t5 > 200\text{ms}$ ;
- t6 :  $t6 > 200\text{ms}$ ;





## 10. OPTICS

### 10.1 Optical characteristics

Note1 ,Note2

| Parameter Note1      |       | Condition  | Symbol | min.    | typ.    | max.    | Unit               | Remarks |
|----------------------|-------|--|--------|---------|---------|---------|--------------------|---------|
| Luminance            |       | White at center<br>θR=0°, θL=0°<br>θU=0°, θD=0°        | L      | 200     | 250     | -       | cd/ m <sup>2</sup> | -       |
| Contrast ratio       |       | White/Black at center<br>θR=0°, θL=0°,<br>θU=0°, θD=0° | CR     | 400     | 600     | -       | -                  | Note3   |
| Luminance uniformity |       | White<br>θR=0°, θL=0°, θU=0°, θD=0                     | LU     | -       | 1.25    | 1.33    | -                  | Note4   |
| Chromaticity         | White | X coordinate   | Wx     | 0.273   | 0.313   | 0.353   | -                  | Note5   |
|                      |       | Y coordinate   | Wy     | 0.289   | 0.329   | 0.369   | -                  |         |
|                      | Red   | X coordinate   | Rx     | (0.592) | (0.632) | (0.672) | -                  |         |
|                      |       | Y coordinate   | Ry     | (0.315) | (0.355) | (0.395) | -                  |         |
|                      | Green | X coordinate   | Gx     | (0.304) | (0.344) | (0.384) | -                  |         |
|                      |       | Y coordinate   | Gy     | (0.568) | (0.608) | (0.648) | -                  |         |
|                      | Blue  | X coordinate   | Bx     | (0.113) | (0.153) | (0.193) | -                  |         |
|                      |       | Y coordinate   | By     | (0.047) | (0.087) | (0.127) | -                  |         |
| Color gamut          |       | θR=0°, θL=0°, θU=0°, θD=0<br>At center,against NTSC    | C      | 50      | 60      | -       | %                  |         |
| Response time        |       | White to black   | Ton    | -       | 3       | (5)     | ms                 | Note6   |
|                      |       | Black to white   | Toff   | -       | 5       | (7)     | ms                 |         |
|                      |       | Ton+ Toff  | -      | -       | 8       | (12)    | ms                 |         |
| Viewing angle        | Right | CR≥10  | θR     | 70      | 80      | -       | °                  | Note7   |
|                      | Left  | CR≥10  | θL     | 70      | 80      | -       | °                  |         |
|                      | Up    | CR≥10  | θU     | 70      | 80      | -       | °                  |         |
|                      | Down  | CR≥10  | θD     | 70      | 80      | -       | °                  |         |

Note1: The values in upper table are only initial characteristics.

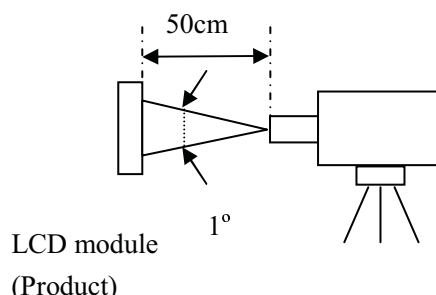
Note2: All measurement conditions are as follows.

Ta= 25°C, VDD= 3.3V, VCC=12V, 100% brightness,

With typical timing characteristics.

Optical characteristics are measured after 30minutes light-on time in the dark room. Also measurement method for luminance is as follows.





Luminance Meter (TOPCON BM-5A)

Spectroradiometer(TOPCON SR-3)

Note 3: See“**10.2 Definition of contrast ratio**”.

Note 4: See“**10.3 Definition of luminance uniformity**”.

Note 5: CIE 1931 Chromaticity Diagram Standard.

Note 6: See “**10.4 Definition of response time**”.

Note 7: See “**10.5 Definition of viewing angle**”.

## 10.2 Definition of contrast ratio

The contrast ratio is calculated by using the following formula.

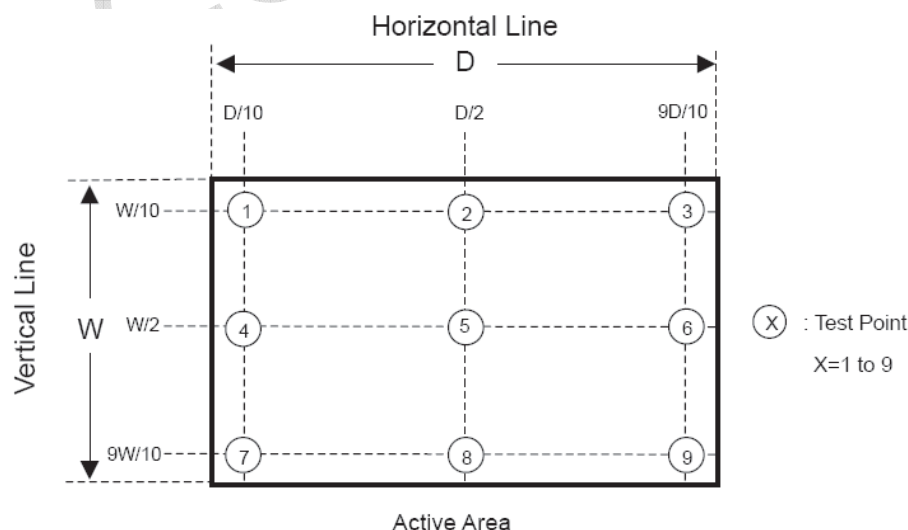
$$\text{Contrast ratio (CR)} = \frac{\text{Luminance of white screen}}{\text{Luminance of black screen}}$$

## 10.3 Definition of luminance uniformity

The luminance uniformity is calculated by using the following formula.

$$\text{Luminance uniformity (LU)} = \frac{\text{Maximum luminance from ① to ⑨}}{\text{Minimum luminance from ① to ⑨}}$$

The luminance is measured at near the 9 points shown below.



## 10.4 Definition of response times

Response time is measured, the luminance changes from “white” to “black”, or “black” to

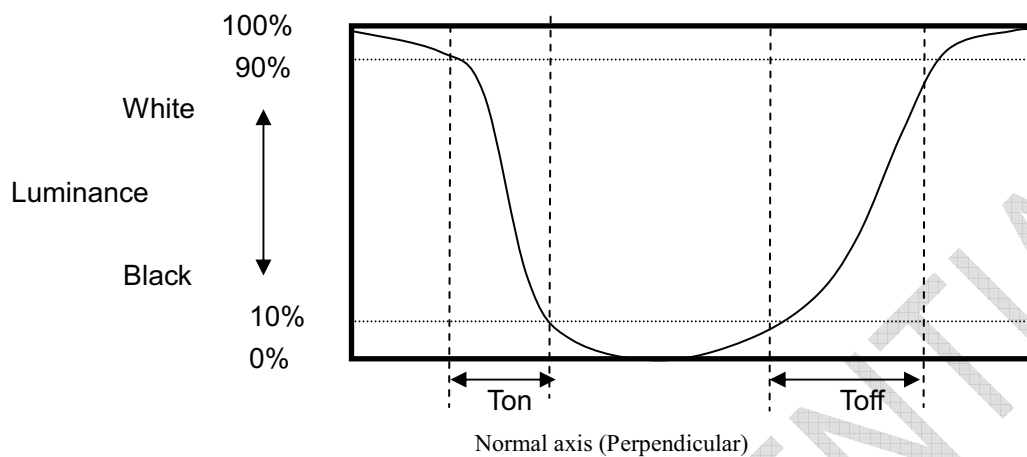
The information contained herein is the exclusive property of SHANGHAI AVIC OPTOELECTRONICS Corporation, and shall not be distributed, reproduced, or disclosed in whole or in part without prior written permission of SHANGHAI AVIC OPTOELECTRONICS Corporation.



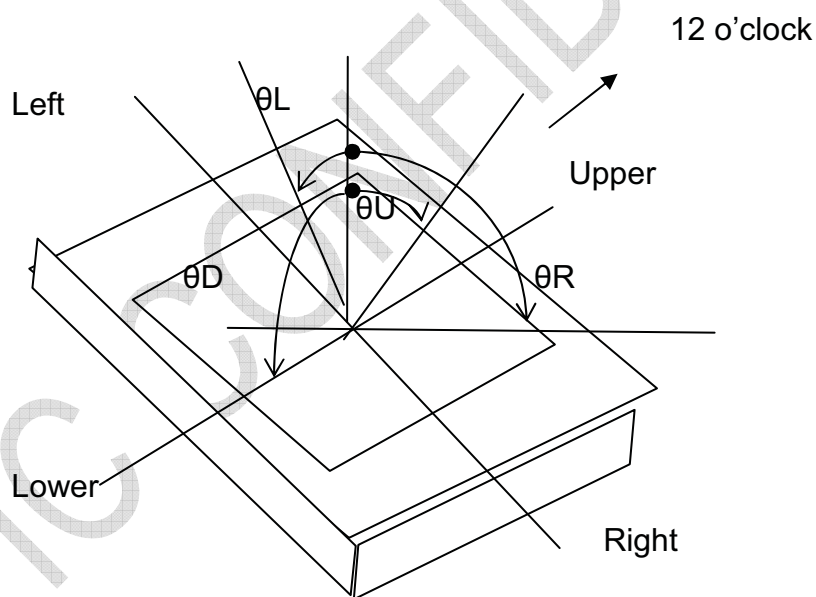
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“white” on the same screen point, by photo-detector. Ton is the time it takes the luminance change from 90% down to 10%. Also Toff is the time it takes the luminance change from 10% up to 90%. (See the following diagram.)



## 10.5 Definition of viewing angles





## 11. MARKINGS

The various markings are attached to this product. See “11.2 INDEICATION LOCATIONS” for attachment positions.

### 11.1 PRODUCT LABEL



Note1: The meaning of OEM number

•Example: TM5XG10A55SA1SA19CF0001

|                    |           |      |
|--------------------|-----------|------|
| TM5XG10A55SA1SA1   | 9CF       | 0001 |
| AVIC internal code | Date code | S/N  |

#### Date code:

1st Character Year Codes

| Month | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | So on |
|-------|------|------|------|------|------|------|------|------|------|-------|
| Code  | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    |       |

2nd Character Month Codes

| Month | January | February | March | April | May | June | July | August | September | October | November | December |
|-------|---------|----------|-------|-------|-----|------|------|--------|-----------|---------|----------|----------|
| Code  | 1       | 2        | 3     | 4     | 5   | 6    | 7    | 8      | 9         | A       | B        | C        |

3rd Character Day Codes

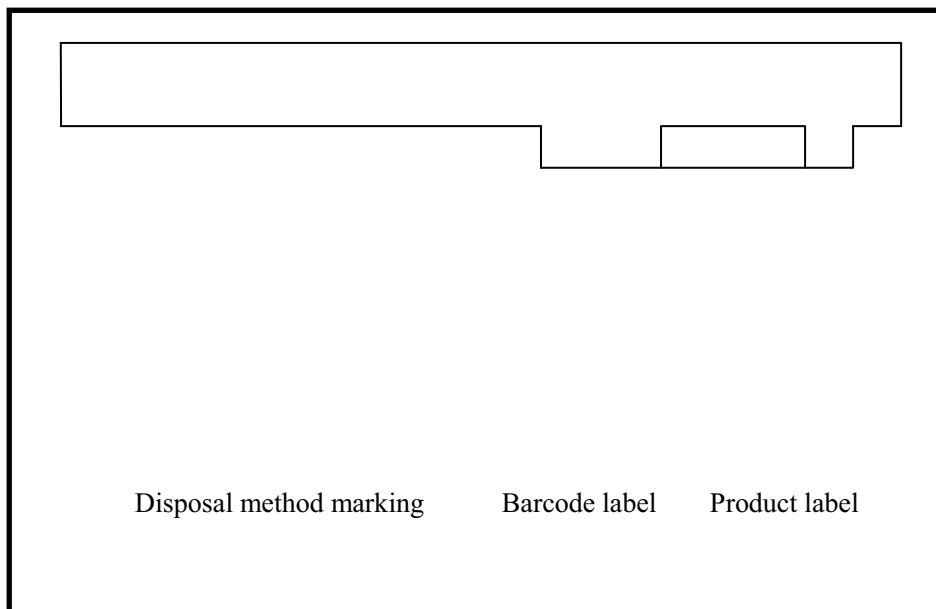
| Day  | 1st  | 2nd  | 3rd  | 4th  | 5th  | 6th  | 7th  | 8th  | 9th  | 10th | 11st |
|------|------|------|------|------|------|------|------|------|------|------|------|
| Code | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | A    | B    |
| Day  | 12nd | 13rd | 14th | 15th | 16th | 17th | 18th | 19th | 20th | 21st | 22nd |
| Code | C    | D    | E    | F    | G    | H    | I    | J    | K    | L    | M    |
| Day  | 23rd | 24nd | 25st | 26nd | 27rd | 28th | 29th | 30th | 31st |      |      |
| Code | N    | O    | P    | Q    | R    | S    | T    | U    | V    |      |      |

Note2: Do not attach anything such as label and so on, on the product label! In case repair the product, AVIC needs the contents of product label such as the lot number, inspection date and so on, to identify the warranty period with individual product. If AVIC cannot decipher the contents of product label, such repair shall be entitled to charge. Also AVIC may give a new lot number to reconditioned products.



## 11.2 INDICATION LOCATIONS

Product rear side





## 12. PACKING, TRANSPORTATION AND DELIVERY

AVIC will pack products to deliver to customer in accordance with AVIC packing specifications, and will deliver products to customer in such a state that products will not suffer from a damage during transportation .The delivery conditions are as follows.

### 12.1 PACKING

#### (1) Packing box

6 products are packed up with the maximum in a packing box (See “**12.5 OUTLINE FIGURE FOR PACKING**”).

Products are put into a plastic bag for prevention of moisture with cushion, and then the bag is sealed up with heat sealing.

The type name and quality are shown on outside of the packing box, either labeling or printing.

#### (2) Pallet Packing (See”**12.5 OUTLINE FIGURE FOR PACKING**”)

① Packing boxes are tired on a cardboard pallet. (8 boxes×4 tiers maximum)

② Cardboard sleeve and top cap are attached to the packing boxes, and then they are fixed by a band.

### 12.2 INSPECTION RECORD SHEET

Inspection record sheets are included in the packing box with delivery products to customer. It is summarized to a number of products for pass/fail assessment.

### 12.3 TRANSPORTATION

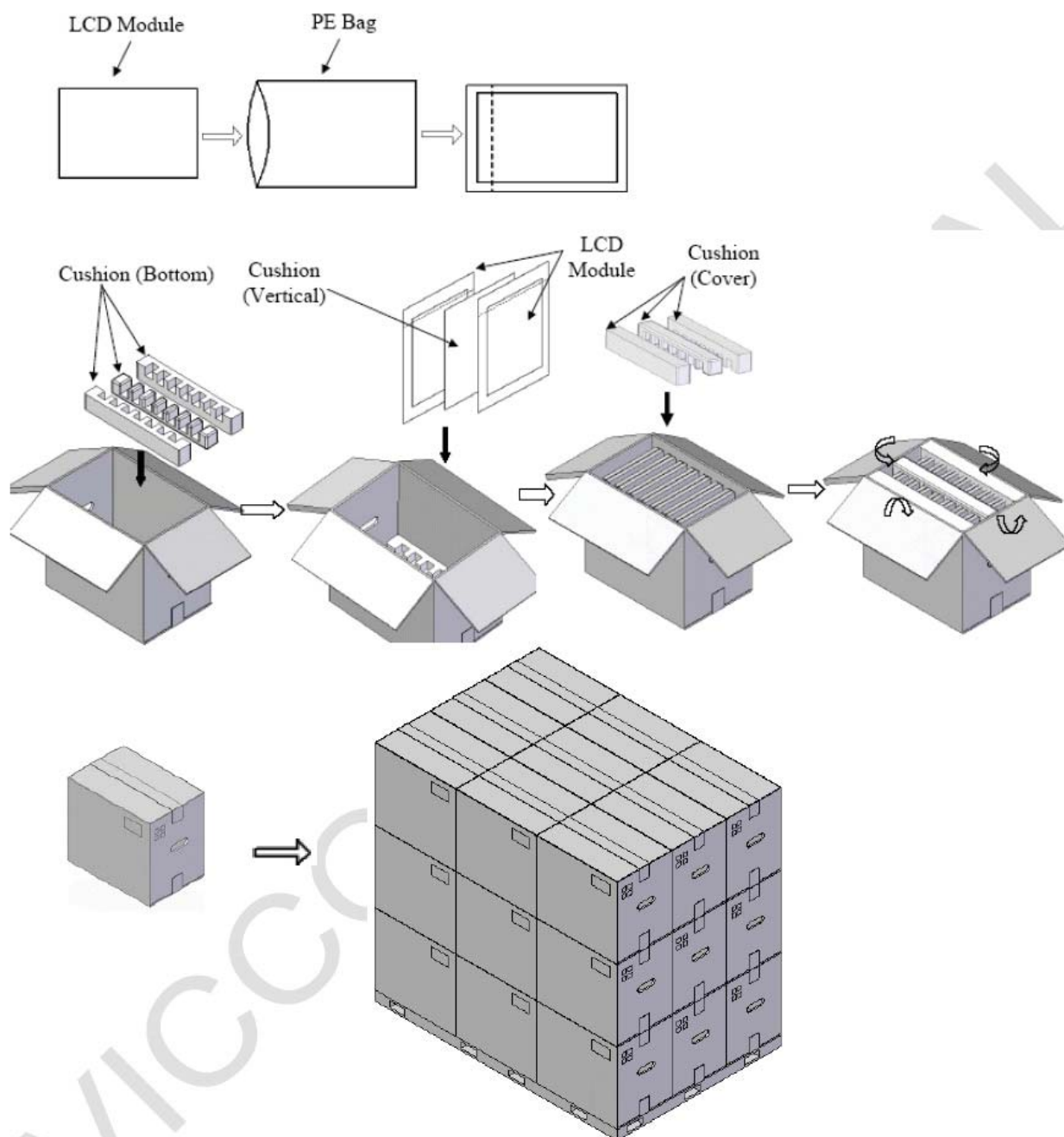
The product is transported by vehicle, aircraft or shipment in the state of pallet packing.

### 12.4 SIZE AND WEIGHT FOR PACKING BOX

| Parameter    | Packing box                        | Unit |
|--------------|------------------------------------|------|
| Size         | 378 (L) x368 (W) x315.5 (H) (typ.) | mm   |
| Weight       | 1 (typ.)                           | kg   |
| Total weight | 14.6 (typ.)<br>(with 14 products)  | kg   |



## 12.5 OUTLINE FIGURE FOR PACKING





## 13. PRECAUTIONS

### 13.1 ATTENTIONS

#### 13.1.1 Handling of the product

- ① Take hold of both ends without touch the circuit board when customer pulls out products (LCD modules) from inner packing box. If customer touches it, products may be broken down or out of adjustment, because of stress to mounting parts.
- ② Do not hook cables nor pull connection cables such as flexible cable and so on , for fear of damage.
- ③ If customer puts down the product temporarily, the product puts on flat subsoil as a display side turns down.
- ④ Take the measures of electrostatic discharge such as earth band, ionic shower and so on, when customer deal with the product, because products may be damaged by electrostatic.
- ⑤ The torque for mounting screws must never exceed 0.34N-m. Higher torque values might result in distortion of the bezel.
- ⑥ The product must be installed using mounting holes without undue stress such as bends or twist (See outline drawings).And do not add undue stress to any portion (such as bezel flat area) except mounting hole portion.
- ⑦ Bends or twist described above and undue stress to any portion except mounting hole portion may cause display un-uniformity.
- ⑧ Do not press or rub on the sensitive display surface .If customer clean on the panel surface, AVIC recommends using the cloth with ethanolic liquid such as screen cleaner for LCD.
- ⑨ Do not push-pull the interface connectors while the product is working, because wrong power sequence may break down the product.
- ⑩ Do not bend or unbend the lamp cable at the near part of the lamp holding rubber, to avoid the damage for high voltage side of the lamp. This damage may cause a lamp breaking and abnormal operation of high voltage circuit.

#### 13.1.2 Environment

- ① Do not operate or store in high temperature, high humidity, dewdrop atmosphere or corrosive gases. Keep the product in antistatic pouch in room temperature, because of avoidance for dusts and sunlight, if customer stores the product.
- ② In order to prevent dew condensation occurring by temperature difference, the product packing box must be opened after leave under the environment of an unpacking room temperature enough. Because a situation of dew condensation occurring is changed by the environment temperature and humidity, evaluate the leaving time sufficiently. (Recommendation leaving time: 6 hour or more with packing state)
- ③ Do not operate in a high magnetic field .Circuit boards may be broken down by it.
- ④ This product is not designed as radiation hardened.
- ⑤ Use an original protection sheet on the product surface (polarizer). Adhesive type protection sheet should be avoided, because it may change color or properties of the polarizer.





### 13.3.3 Characteristics

**The following items are neither defects nor failures.**

- ① Optical characteristics (e.g. luminance, display uniformity, etc.) gradually is going to change depending on operating time.
- ② Do not display the fixed pattern for a long time because it may cause image sticking .Use a screen saver, if the fixed pattern is displayed on the screen.
- ③ The display color may be changed by viewing angle because of the use of condenser sheet in the backlight.
- ④ Optical characteristics may be changed by input signal timings.
- ⑤ The interference noise of input signal frequency for this product and luminance control frequency of customer's backlight PWM signal may appear on a display. Set up luminance control frequency of backlight so that the interference noise doses not appear.

### 13.2 Other

- ① All GND and VCC terminals should be used without a non-connected line.
- ② Do not disassemble a product or adjust volume without permission of AVIC.
- ③ Pay attention not to insert waste materials inside of products, if customer uses screw nails.
- ④ Pack the product with original shipping package, because of avoidance of some damages during transportation, when customer returns it to AVIC for repair and so on.
- ⑤ Not only the module but also the equipment should be packed and transported as the module becomes vertical .Otherwise, there is the fear that a display dignity decreases by an impact or vibration

## 14. OUTDRAWING

TBD